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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s) : Bardelmeier, et al.
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For : PROCESS AND APPARATUS FOR THE PARTIAL
THERMOCHEMICAL VACUUM TREATMENT OF
METALLIC WORKPIECES
Art Unit : To be assigned
Examiner : To be assigned

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Commissioner of Patents
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Washington, D.C. 20231

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Eileen Sheffield

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Date

Eileen Sheffield 10/31/02

PRELIMINARY AMENDMENT

Sir:

In advance of prosecution, please amend the above-identified patent application as follows:

IN THE CLAIMS

Please cancel claims 1-35 without prejudice and add the following new claims:

36. A process for the partial thermochemical vacuum treatment of metallic workpieces, in particular for the carburization and case-hardening of workpieces of case-hardening steel in a carbon-containing atmosphere, wherein surface regions to be treated and

surface regions not to be treated abut one another, and wherein the surface regions not to be treated are covered during the treatment of the remaining surface regions by reusable mold bodies of a temperature-resistant material, characterized in that for the simultaneous treatment of several workpieces with defined cavities the workpieces are installed in a mold body having at least one mold cavity and several openings through which the carbon containing atmosphere enters the cavities of the workpieces, in which the mold body encloses the workpieces in such a way that no thermochemical treatment takes place on the external surface regions of the said workpieces.

37. A process according to claim 36, wherein in each case at least one surface region of the cavity of the workpiece is screened by means of an inserted sleeve against a thermochemical treatment, whereas at least one further surface region of the cavity is subjected to the thermochemical treatment.

38. A process according to claim 36, wherein the thermochemical treatment is carried out under the action of a plasma and that the mold body consists of an electrically conducting material.

39. A process according to claim 36, wherein a mold body having a plurality of mold cavities is used for receiving in each case one workpiece.

40. A process according to claim 36, wherein the mold body is formed as a housing with an upper part and that at least the upper part has openings that communicate with the cavities in the workpieces and through which the carbon-containing atmosphere enters the said workpieces.

41. A process according to claim 36, wherein between the surface regions not being treated of the workpieces and the mold body sleeves are employed for sealing purposes.

42. A process according to claim 36, wherein a plurality of mold bodies are combined to form a batch.

43. A process according to claim 36, wherein the process is carried out in a vacuum range between 10 Pa and 3000 Pa.

44. A process according to claim 37, wherein the process is carried out with plasma voltages of between 200 and 2000 volts.

45. A process according to claim 44, wherein the plasma is used in pulsed form.

46. A process according to claim 45, wherein the connection time is between 10 and 200 μ s and the pause time is between 10 and 500 μ s.

47. A process according to claim 36, wherein the carbon-containing gas is at least one hydrocarbon selected from the group consisting of methane, ethane, propane and acetylene.

48. A process according to claim 47, wherein at least one gas selected from the group consisting of argon, nitrogen and hydrogen is added to the carbon-containing gas wherein, the proportion of the at least one hydrocarbon being chosen between 10 and 90 vol. %.

49. A process according to claim 36, wherein the material for the mold bodies.

50. A process according to claim 36, wherein CFC is used as material for the mold bodies.

51. A process according to claim 36, wherein a material that does not exhibit any distortion phenomena at a temperature of at least 1050°C is used as material for the mold bodies.

52. A process according to claim 38, wherein the plasma-side ends of the at least one mold cavity of the mold bodies are formed in a plasma-tight manner opposite the respective workpiece.

53. A process according to claim 36, wherein the workpieces within the mold body are subjected to a heating procedure before the carburization.

54. A process according to claim 36 wherein the workpieces within the mold body are subjected to a diffusion procedure after the carburization.

55. A process according to claim 36, wherein the workpieces within the mold body are subjected to a high pressure gas quenching after the diffusion procedure.

56. A process according to claim 36, wherein the workpieces within the mold body are subjected after the high pressure gas quenching to at least one further treatment from the group consisting of deep cooling and annealing.

57. An apparatus for use in a single-chamber unit or in a multi-chamber throughflow unit for the partial thermochemical vacuum treatment of metallic workpieces, in particular for the carburization and casehardening of workpieces of case-hardening steel in a carbon-containing atmosphere, wherein surface regions to be treated and surface regions not to be treated abut one another, and at least one reusable mold body that consists of a temperature-resistant material is provided to cover surface regions not to be treated during the treatment of the remaining surface regions, characterized in that in the mold body several mold cavities are provided for the insertion of several workpieces, wherein the workpieces can be enclosed in the mold cavity in such a way that no thermochemical treatment takes place on the external surfaces of the workpieces.

58. An apparatus according to claim 57, wherein the mold body is formed as a housing and consists of an electrically conducting material and that the workpieces can be enclosed in the mold cavity in such a way that when using a plasma no plasma is formed between the mold body and the workpieces.

59. An apparatus according to claim 57, wherein the mold body for the treatment of the workpieces with cavities that are subjected to a thermochemical vacuum treatment has several openings that communicate with the cavities of the in each case associated workpieces

60. An apparatus according to claim 57, wherein the mold body is formed as a housing with an upper part, and that at least the upper part has several openings that communicate with the cavities in the in each case associated workpieces.

61. An apparatus according to claim 60, wherein the mold body comprises a lower part that has several openings, and that the axes of the openings in the upper part and in the lower part coincide.

62. An apparatus according to claim 61, wherein between the lower part and upper part of the mold body there is arranged a separating groove running along the circumference, which permits a telescopic movement between the lower part and upper part.

63. An apparatus according to claim 58, wherein the plasma-side ends of the openings in the mold body opposite the respective workpiece are formed in a plasma-tight manner.

64. An apparatus according to claim 57, having sleeves that can be inserted between the workpiece and the lower part on the one hand and between the workpiece and the upper part on the other hand, and which match the workpiece in such a way that surface regions of the workpieces not being treated are excluded from the thermochemical treatment.

65. An apparatus according to claim 57, wherein a plurality of mold bodies are combined by means of a transporting frame to form a batch.

66. An apparatus according to claim 65, wherein the transporting frame comprises crosspieces for arranging mold bodies next to one another and on top of one another.

67. An apparatus according to claim 57, wherein the mold body consists of graphite.

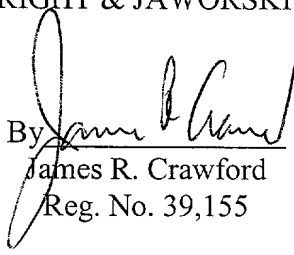
68. An apparatus according to claim 57 wherein the mold body comprises CFC.
69. An apparatus according to claim 57, wherein the mold bodies comprise a material that does not exhibit any distortion phenomena at a temperature of at least 1050°C.
70. An apparatus according to claim 58, wherein that the mold body is arranged within an evacuable chamber with an inlet for at least one hydrocarbon and is connected as a cathode for the formation of a plasma.
71. A process according to claim 43, wherein the process is carried out in a vacuum range between 50 Pa and 1000 Pa.
72. A process according to claim 44 wherein the process is carried out with plasma voltages between 300 and 1000 volts.
73. An apparatus according to clam 69, wherein the material does not exhibit any distortion phenomena at a temperature of up to at lest 1200°C.

REMARKS:

The Commissioner is hereby authorized to charge any deficiency in the fees filed, asserted to be filed or which should have been filed herewith (or with any paper hereafter filed in this application by this firm) to our Deposit Account No. 50-0624, under Order No. NY-ALD-231.1-US. A duplicate copy of this paper is enclosed.

Respectfully submitted

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